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16 September 1980

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SCIENCE AND TECHNOLOGY

No. 57

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MISSILE TEST RANGE, ICBM FACILITY DESCRIBED

Shanghai KEXUE HUABAO [SCIENCE PICTORIAL] in Chinese No 6, Jun 80 pp 1-2

[Article: "A Flight of Over 8,000 Kilometers"]

[Text] On the 4 to 5-meter-high launch platform stands a rocket several dozen meters high. Suddenly, the launch platform is enshrouded in smoke as a stream of flame erupts from the tail of the rocket. In a thunderous roar, the rocket climbs from the shroud of smoke and lifts off from the launch pad. It quickly becomes a speck of light and then disappears into the heavens. This is the scene as a full-range target exercise with an ICBM gets underway.

Why a Full-range ICBM Target Exercise Is Held

For the ICBM as a weapon, accuracy is of paramount importance. Many factors effect the accuracy of the ICBM; for example, when the missile nears an enemy target it must re-enter the atmosphere from an altitude of 100 kilometers and more. At this time, because of the high velocity of the missile (about 7.3 kilometers/second) the nose creates friction with the air and the surface heats up with a resulting uneven distribution of mass of the nose cone. This produces pitching and rolling and the missile may stray from its predetermined point of impact. When the ICBM enters enemy airspace, the enemy's missile defense system begins to jam it after which antimissile missiles are fired to intercept it. As a result, the ICBM must possess a certain penetration capability before it can hit an enemy target. A full-range ICBM target exercise is the firing of a missile at a predetermined target over 8,000 kilometers away. Accuracy, penetration capability and other characteristics determined from the target tests may then be applied to a weapon to be used in actual warfare.

Even though a full-range target exercise with an ICBM involves the expenditure of great amounts of money, material, and time, it plays a vital role in the development and manufacture of an ICBM. It is the final link in the experimental process and as a result, countries which develop and produce ICBMs attach special importance to full-range target exercises. For example, from 1960 to 1978, the Soviet Union conducted 29 such experiments. From February 1961 to May 1970, the United States held 540 tests with the "Minuteman" missile.

How a Full-range ICBM Target Exercise Is Conducted

The launch and flight stages of a full-range test involve the missile test range, the flight zone, and the impact zone, responsible for launch control, tracking and splashdown respectively.

The Missile Test Range [launch site]

There are close to 100 well-equipped missile test ranges in the world today. As a rule, the areas selected for the test ranges are flat, sparsely populated, and provided with convenient communications. These ranges consist of technical installations, launch facilities, launch control centers, etc.

The technical installations house the missile check-out facilities which conduct missile equipment and performance tests and inspections, after which the missile is moved to the launch pad on a transport vehicle.

This facility contains the launch pad, the gantry, fuel and oxygen storage, optical and photography equipment, radio tracking and telemetry facilities, and fire fighting and rescue equipment, etc., to support the launching of the missile. Not too far from the launch pad is the launch control block-house which controls the ignition and lift-off and records the time the missile leaves the launch pad. The launch control center is the "nerve center" of the missile test range. It consists of weather communications systems, electronic computers and various display equipment.

In a full-range ICBM target exercise, the only way to reduce the effect of the weather on the missile experiment to a minimum is to select a clear day during which the wind velocity is low. Therefore, it is necessary to organize all the weather stations in the entire area (from the point of launch to the point of impact) into a weather reporting network to feed back the weather conditions at each station to the launch control center. The ICBM launch time is then determined from long-, medium- and short-range weather forecasts.

The launch control center's communications system is massive, employing virtually every means of communications. All information is fed into this system and relayed to the launch control center where it is processed by computer, recorded, and shown on special display equipment.

The launch control center's display equipment consists chiefly of large screens and panels which display the missile test situation [status]. For example, the trajectory chart panel displays the missile's velocity and position, the trajectory, the projected point of impact, etc. The missile status panel shows the missile launch time and flight status, roll, pitch, etc., through data supplied via telemetry and can produce real-time displays. The range weather board shows the weather conditions at all points along the range.

In order to coordinate the launching of the missile, its flight and impact time, the launch control center is also equipped with systems to synchronize time.

The Flight Zone

This is the area on either side of the missile's flight path. Tracking stations and vessels are located within this zone. Their mission is to track the missile in flight, conduct monitoring and receive data via telemetry which they relay back to the launch control center. ICBM flight zones are usually situated in regions far from large cities and major industrial centers so that casualties can be held to a minimum in case the missile gets off course. For example, for the U.S. range which extends from Florida's Cape Kennedy to Ascencion Island, most of the ICBM flight zone is over the Atlantic Ocean. Thirteen tracking stations flank this zone.

The tracking stations have radar measurement systems, optical tracking equipment, telemetry systems and remote control command systems. The radar systems are responsible for precise real time measurement of the missile's trajectory and for area security. The optical tracking equipment monitors the missile's angle of site and azimuth, continuously photographing its position, attitude and roll. The antennas of the telemetry system measure 8 to 10 meters in diameter and can receive long-range telemetry signals which instantly determine the performance of each part of the missile, temperature, pressure, etc., and determine whether the missile is functioning normally or not; the remote control command set-up takes care of security within the flight zone. The launch control center makes decisions based on the radar measurement systems, telemetry, missile trajectory and performance. If the missile's flight is abnormal, the control personnel can, by remote control, issue orders to either correct the malfunction or destruct the missile.

The Impact Zone

This denotes the target area. The Pacific impact zone of the United States is within an oval formed by Wake Island, and Eniwetok and Kwajalein in the Marshalls. On 15 January 1960, when the Soviet Union held its first ICBM test, the impact zone was a rectangular area of ocean measuring 134 X 267 kilometers.

Mid-ocean areas are selected for impact zones. Here, islands are widely scattered, major air routes can be avoided, and wind and waves are more gentle and the weather is for the most part constant. The function of the impact zone is to rely on the tracking ships, aircraft and submarines as well as facilities on nearby islands to monitor the missile's trajectory and performance in a test of the missile's defense penetration capability and to conduct impact point determination and underwater search for the nose.

As the missile flies over the impact zone, radar aboard the tracking vessels determine its trajectory, predict the point of impact and receive telemetry on the heating up of the nose cone as it enters the atmosphere and relay [the data] to the launch control center.

In a test of the missile's defense penetration capability, simulated enemy missile defense systems are situated in the impact zone. After the defense system has been successfully penetrated, the ICBM then plunges into the sea at the impact zone. At this time, cameras in unmanned aircraft take continuous photographs of both the nose and the target, recording range and position. Simultaneously, an underwater sound probe located in the impact area picks up the sound of the nose crashing into the sea and then locates its position in the water. An antenna on the probe relays the position of the nose to a tracking ship which later retrieves the nose. Past retrieval used to depend on divers but today the United States has developed a two-man submarine to perform this task.

The Significance of a Successful Full-range ICBM Target Exercise

Space technology is a comprehensive technology involving every aspect of science and technology. The success of a full-range target exercise demonstrates a country's level of development of space technology. In the 1960s, the USSR, the United States and other countries one after another announced successful tests which shook the world at the time and caught the attention of every nation on earth.

A full-range ICBM target test is a test of everything from the launch site to the technical performance and reliability of the ground facilities. It trains the units which will use [the missiles], a matter of great importance in being prepared for war. Thus, ICBM full-range target tests are an indication of a country's defense modernization.

CSO: 8111/1654

APPLIED SCIENCES

BEIJING COMPLETES SURVEY OF EARTHQUAKES

HK290454 Beijing City Service in Mandarin 2300 GMT 22 Aug 80

[Text] The mass effort in seismology and geology organized by Beijing Municipality has scored great success after almost 4 years' work. After studying earthquake movements and the relations between geological structures, scientists have given their opinions on the trend of earthquake movements in the Beijing area. At the same time, they studied and discussed the earthquake zones and the effects of shocks, and made forecasts.

North China is a region in our country where earthquakes are frequent. The severe Tangshan earthquake in 1976 affected Beijing. Leaders of the municipal CCP committee were very much concerned about the earthquake situation in the Beijing area and the pattern and degree of shocks. After repeated research, the committee decided to let Beijing Municipal Geological Bureau take the lead to summon central units in Beijing and municipal units concerned to launch a mass effort in seismology and geology. The mass effort was commanded personally by a vice mayor, and an office was established. Twenty renowned seismology and geology specialists and professors including (Huang Jiqing), (Yin Zhanxin), (Gu Gongxu), (Fu Chengyi), (Zhang Wenyu), (Hou Renzhi), (Wang Ren), (Zhou Ka) were appointed advisers. A force of nearly 4,000 people from 52 scientific research, teaching and production units and departments was formed.

The mass effort started in October 1976 and was completed in July 1980, taking about 4 years to complete. During the 4 years, they gathered and sorted out a lot of information concerning seismology and geology in an all-round way, and launched seismological and geological field research and experimental investigations. They probed into some relatively important topics and deepened knowledge of Beijing's seismological and geological conditions. Beijing is one of the concentrated earthquake activity zones in northern China, with main faults in five directions. These are twisted and knitted in networks, thus forming the framework of the Beijing faults. Modern seismological activities show that minor earthquakes chiefly happen in belts along the Huangzhuang-Gaoliying fault and along the Nankou-Senhe fault. Most of the foci are at a depth of 10 to 20 kilometers.

In accordance with researches on seismological activities and the relations between the geological structures, the seismological and geological workers summed up results of their studies in eight special topics and initially aired their views on earthquake activities in the Beijing region. They discussed the sectors of earthquake shocks and made forecasts on the harmful effects of earthquakes. During the 4 years of studies, they scored many individual achievements and successively completed more than 70 scientific reports and research papers. About 20 of them were published in papers and magazines such as ZHONGGUO KEXUE, and 5 achievements won scientific research prizes from Beijing Municipality and the Academy of Science in 1979. These achievements have important practical significance for future earthquake precautions and counter-measures in Beijing as well as for rational planning of the construction of the capital.

CSO: 4008

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CS0: 4008

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- [Text] Asymptotic Error Estimations for Spline Interpolation Function and Their Applications in Numerical Differentiations Huang Youqian [7806 0645 6197], Department of Mathematics and Mechanics (1)
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CS0: 4008

AUTHOR: DING Dajun [0002 1129 6874]
PANG Tonghe [1690 0681 0735]

ORG: None

TITLE: "Experimental Research on Reinforced Concrete and Prestressed Concrete Flexural Members under Long-Term Loading"

SOURCE: Beijing JIANZHU JIEGOU XUEBAO [JOURNAL OF BUILDING STRUCTURES] in Chinese Vol 1 No 3, 5 Aug 80 pp 1-11

TEXT OF ENGLISH ABSTRACT: This paper presents the test results of deflections and crack-widths of two series of reinforced concrete beams and four series of uncracked and cracked prestressed concrete beams under long-term loading. All the experiments had been carried on continuously for 14 years. Deflection increase curves together with the corresponding temperature and relative humidity change curves are plotted. A practical formula which is conjoint with that given in the current code TJ 10-74 for calculating the stiffness of cracked reinforced concrete beams is recommended in the appendix. The results computed by the proposed formula agree with the test data of 182 beams at home and abroad.

AUTHOR: None

ORG: Research Group on Shear Wall Structures of Tall Buildings

TITLE: "Dynamic Experiments and Analysis of Shear Wall Structural Model"

SOURCE: Beijing JIANZHU JIEGOU XUEBAO [JOURNAL OF BUILDING STRUCTURES] in Chinese Vol 1 No 3, 5 Aug 80 pp 12-23

TEXT OF ENGLISH ABSTRACT: This paper reports the tests of an eight-story shear wall structural model (1/20-scale) on a shaking table. Dynamic characteristics of shear wall structures, elastoplastic dynamic response, credibility of joints and failure mechanism of structure were investigated. The measured data of elastoplastic dynamic response were compared with theoretical values calculated by multimass system dynamic response analysis of tall building structures. The results were in good agreement and showed that the structures will have sufficient earthquake resistance when reasonable structural details and adaptable percentage of reinforcement are provided.

AUTHOR: QIU Shengyu [6726 5110 3842]

ORG: Beijing Institute of Architectural Design

TITLE: "Regularities of Seismic Stresses Variation of Multistory Frame Structures--To Prepare Ground for Standardization of Such Structural Members"

SOURCE: Beijing JIANZHU JIEGOU XUEBAO [JOURNAL OF BUILDING STRUCTURES] in Chinese Vol 1 No 3, 5 Aug 80 pp 24-35

TEXT OF ENGLISH ABSTRACT: The seismic stresses in the members of multistory frame structures with shear walls are influenced by many factors, such as the strength and positions of shear walls, the height of the building, the magnitude of torsion due to the eccentricity of its mass and so on. As a result of a considerable amount of systematic computations and theoretical analyses, it was found that there are regularities within these stresses, no matter how complicated they are. The regularities demonstrated in this paper will provide favorable conditions for standardization of such members and serve as a reference for individual designs.

AUTHOR: LU Nengyuan [7120 5174 3293]
FENG Mingshuo [7458 6900 4311]

ORG: Both of the South China Institute of Technology

TITLE: "Design of Composite Action Brick and Reinforced Concrete Wall Beams"

SOURCE: Beijing JIANZHU JIEGOU XUEBAO [JOURNAL OF BUILDING STRUCTURES] in Chinese Vol 1 No 3, 5 Aug 80 pp 36-42

TEXT OF ENGLISH ABSTRACT: Based on a large amount of test data and theoretical and statistical analysis, a method for designing composite action solid brick and reinforced concrete wall beams is presented and explained. The proposed design provisions include the design equations for evaluation of flexural strength, local bearing strength and shear strength of the composite wall beams under vertical loads and some principal detailing requirements. The load carrying characteristics and the design requirements of the composite wall beams under horizontal forces with special regard to earthquakes are also briefly discussed.

AUTHOR: CAI Shaohuai [5591 4801 2017]

ORG: Chinese Academy of Building Research

TITLE: "Limit Analysis of Rectangular Reinforced Concrete Slabs under Linearly Varying Distributed Loads"

SOURCE: Beijing JIANZHU JIEGOU XUEBAO [JOURNAL OF BUILDING STRUCTURES] in Chinese Vol 1 No 3, 5 Aug 80 pp 43-48

TEXT OF ENGLISH ABSTRACT: In this paper, an approximate limit analysis of rectangular reinforced concrete slabs under linearly varying distributed loads based on the limit design yield-line pattern at failure for the case of uniformly distributed loads is examined. The formula derived is found to be the same as that of the uniformly distributed loads provided the local intensity is replaced by the average intensity of the linearly varying distributed load. The computed results are compared with those obtained by the rigorous method. It is proved that the possible errors will be within the permitted limits in engineering practice.

AUTHOR: CHEN Minsan [7115 3046 0005]

ORG: Central Design Institute, First Ministry of Machine Building

TITLE: "On the Development of the Industrial Building Structural Systems"

SOURCE: Beijing JIANZHU JIEGOU XUEBAO [JOURNAL OF BUILDING STRUCTURES] in Chinese Vol 1 No 3, 5 Aug 80 pp 49-54

TEXT OF ENGLISH ABSTRACT: In this paper, the development of the industrial building structural systems is described, and some problems that must be solved in the course of its progress as well as the ways to solve such problems are presented. In addition, the trend of development of modern industrial buildings is also discussed.

AUTHOR: LIU Jiarong [0491 1367 2837]

ORG: Northwest Design Institute of Architecture, State Administration of Building Construction

TITLE: "Analysis of Grillage Beams on Elastic Foundation by Discrete Strip Method"

SOURCE: Beijing JIANZHU JIEGOU XUEBAO [JOURNAL OF BUILDING STRUCTURES] in Chinese Vol 1 No 3, 5 Aug 80 pp 55-59

TEXT OF ENGLISH ABSTRACT: This paper proposes that the grillage beams on elastic foundation can be analyzed by the discrete strip method. In view of reducing the order of matrix, the displacements of beams are expressed by initial parameters and the force method is also applied to satisfy the condition of compatibility. According to this analytical method, a general computer program is developed for practical use.

AUTHOR: WANG Jiwang [3769 0679 2598]

ORG: Central Building Research Institute, Ministry of Metallurgical Industry

TITLE: "Influence Chart Method for Computing Stresses in Subsoil at Different Depths and Settlement of Foundation"

SOURCE: Beijing JIANZHU JIEGOU XUEBAO [JOURNAL OF BUILDING STRUCTURES] in Chinese Vol 1 No 3, 5 Aug 80 pp 60-73

TEXT OF ENGLISH ABSTRACT: Based on Newmark's influence chart, an improved method of computing stresses in subsoil at different depths by using the influence value curves or tables is developed. In addition, the deformation influence chart, influence value curves and tables for computing the settlement of foundation according to the layers summation procedure given in the current code are also presented. They can be used for both uniform and nonuniform subsoil strata, even for complicated conditions.

Finally, according to the deformation influence chart, the effecting range of the adjacent foundation and loads in the horizontal direction that should be considered is suggested, and this is equal to 1.1 times the thickness of the compressed subsoil layer.

Hydraulic Engineering

AUTHOR: XIAO Tianduo [5135 1131 6995]
QIAN Lin [6929 3876]

ORG: Both of the Water Conservancy and Hydroelectric Power Research Institute

TITLE: "Hydrodynamic Pressures on Various Submerged Walls or Plates Due to Earthquakes"

SOURCE: Beijing SHUILI XUEBAO [JOURNAL OF HYDRAULIC ENGINEERING] in Chinese No 2, 17 Apr 80 pp 1-13

TEXT OF ENGLISH ABSTRACT: In reservoir design one sometimes meets with submerged structures, such as the underwater retaining wall, the foundation-rested immersed plate which connects shore to intake-tower, the half-submerged navigation-guiding plate, a strut plate positioned midway in water depth, and also a diversion wall from shore.

This paper gives a synthetic study of the hydrodynamic pressures on these structures due to earthquakes. The analysis follows the physical model of Westergaard and uses conformal mappings and elliptic functions in obtaining

[Continuation of SHUILI XUEBAO No 2, 17 Apr 80 pp 1-13]

solutions in closed forms. Subsequent pressure profiles and resultant coefficients are calculated and plotted, checked with electrical analogy measurements. Approximation formulas are also given and intended for the use of designers.

AUTHOR: SHEN Zhujiang [3088 3796 3068]

ORG: Nanjing Hydraulic Engineering Research Institute

TITLE: "Analysis of Dynamically Coupled Percolation and Deformation Problems of Saturated Sands"

SOURCE: Beijing SHUILI XUEBAO [JOURNAL OF HYDRAULIC ENGINEERING] in Chinese No 2, 17 Apr 80 pp 14-22

TEXT OF ENGLISH ABSTRACT: Based on the assumption of undrained behavior, the author has proposed previously a finite element method for calculating the pore pressure and permanent deformation of saturated sands during earthquakes. In this paper, the method is extended to include both generation and dissipation of pore pressure coupled with deformation under two-dimensional conditions.

The analytical procedure consists of the earthquake stage and the post-earthquake stage, and each stage is subdivided into several time steps. For the first stage, both dynamic response analysis and static analysis are required for every time step, but the static analysis only is necessary for the post-earthquake stage. The dynamic analysis is based on equivalent nonlinear viscous-elastic model, similar to that proposed by Idriss and Seed in their program QUAD4, and the static analysis is made in the same way as that of

[Continuation of SHUILI XUEBAO No 2, 17 Apr 80 pp 14-22]

Biot's consolidation theory for clay. The dynamic shear modulus and damping ratio are calculated by the formulas provided, proposed originally by Hardin and Drnevich and revised by the author considering simultaneous action of the dynamic normal stress and shear stress by introducing a parameter of coactivity W . From dynamic analysis, the residual volumetric and shear deformation increments are obtained according to the constitutive relationships provided, in which N and ΔN are the equivalent number of uniform cycles and their increments, $\bar{\gamma}_d$ and σ_d are the dynamic shear strain amplitude and dynamic normal stress amplitude, δ is a measure of asymmetry of the dynamic shear stress, and C_1, C_2, C_3, C_4, C_5 are five constants. In the static analysis, the initial strain method is used, hence the above-mentioned volumetric and shear deformation increments are converted to fictive nodal forces.

A response analysis of a sand layer to horizontal bed rock motion is given as an illustration.

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TITLE: "Safety Evaluation in Aseismatic Design of Gravity Dams"

SOURCE: Beijing SHUILI XUEBAO [JOURNAL OF HYDRAULIC ENGINEERING] in Chinese No 2, 17 Apr 80 pp 23-33

TEXT OF ENGLISH ABSTRACT: In this paper a discussion on the adoption of the seismic coefficients and on safety evaluation in aseismatic design of gravity dams on rock foundations is presented. The discussion is based on further investigations of the seismic response of the Xinfengjiang Dam, the Koyna Dam and some other gravity dams selected.

In aseismatic design of gravity dams, usually based on the static method or so-called pseudo-static method using conventional seismic coefficients and static parameters for calculating the shearing strength, a basic evaluation of the overall stability against sliding of the dam subjected to earthquakes, although far from being satisfactory, can usually be obtained. Stress calculation based on such methods, however, is often misleading. Therefore, it is

[Continuation of SHUILI XUEBAO No 2, 17 Apr 80 pp 23-33]

advisable to take a different approach. Applying the method of dynamic analysis and adopting a design seismic coefficient for the expected ground motion of the dam foundation to estimate the earthquake loadings and stresses, combining them with those produced by normal loads and comparing them with the parameters for static strength, one may then arrive at a reasonable safety evaluation of a dam.

This paper deals mainly with the problem of stability against sliding. The authors present the concept of relative seismic stability, which shall be helpful in indicating the rule of stability against the sliding of dams subjected to earthquakes and, consequently, in making sure of the safety of the dam.

In the investigation the dynamic coupling action between the dam and the reservoir water was taken into consideration, the dam and the reservoir water being treated as an assembly of finite elements. The analysis was carried out by both the methods of response spectrum and time-history. The combined effects of dynamic and static loadings were introduced.

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TITLE: "Dynamic Behavior and Earthquake Response of the Dam Section with Inserted Power Station of Fengshuba Dam"

SOURCE: Beijing SHUILI XUEBAO [JOURNAL OF HYDRAULIC ENGINEERING] in Chinese No 2, 17 Apr 80 pp 34-43

TEXT OF ENGLISH ABSTRACT: This paper presents briefly the partial results from model tests and theoretical analyses concerning the dynamic behavior and earthquake response for the dam section with inserted power station of Fengshuba Dam.

The tests have been performed on an electromagnetic vibration table which can be actuated analogously to the actual earthquake records. A two-dimensional response analysis by means of the mode superposition method using subspace

[Continuation of SHUILI XUEBAO No 2, 17 Apr 80 pp 34-43]

inverse iteration method has been made. The results obtained by testing and computing are in agreement.

The investigation indicates that the dynamic behavior and earthquake responses of the dam section with inserted power plant would not have any significant differences as compared with those of other sections.

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CSO: 4009

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TITLE: "Invariant Subspaces and Generalized Invariant Subspaces. (I) Existence and Uniqueness Theorems"

SOURCE: Beijing JISUAN SHUXUE [MATHEMATICA NUMERICA SINICA] in Chinese Vol 2 No 1, Feb 80 pp 1-13

TEXT OF ENGLISH ABSTRACT: This paper discusses some subspaces associated with eigenvalue and generalized eigenvalue problems.

In this paper we define "pair of generalized eigenvalue matrices" and "generalized eigenmatrix" of a pair of matrices, and from these definitions we establish the concept of generalized invariant subspaces; establish the necessary and sufficient conditions for the existence and uniqueness of corresponding subspaces; and give the relationship of generalized invariant subspaces with the "deflating pair" which was defined by G. W. Stewart.

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TITLE: "On an Estimation of the Convergence Rate for the Galerkin Method"

SOURCE: Beijing JISUAN SHUXUE [MATHEMATICA NUMERICA SINICA] in Chinese Vol 2 No 1, Feb 80 pp 14-23

TEXT OF ENGLISH ABSTRACT: Consider the linear operator equation $Au = L_1u + L_2u = f$, where the operator L_1 is V -elliptic (cf. Ciarlet) and $L_1^{-1}L_2$ is compact in the Hilbert space V . A V -estimation of the convergence rate for the Galerkin method is derived in the first part of this paper. This result includes the well-known theorem attributed to Mikhlin. In the second part the error estimation of H -norm (i.e., L^2 -norm) under some conditions is investigated.

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TITLE: "Optimal Error Bounds for Derivatives of Cubic Interpolating Splines with Equidistant Nodes"

SOURCE: Beijing JISUAN SHUXUE [MATHEMATICA NUMERICA SINICA] in Chinese Vol 2 No 1, Feb 80 pp 24-34

TEXT OF ENGLISH ABSTRACT: Let Δ_N be the uniform partition of the interval $[0,1]$ with $\|\Delta_N\| = 1/N$. Suppose $f(x) \in C^4[0,1]$ and $S_{\Delta_N}(f;x)$ is a cubic interpolating spline of $f(x)$ on Δ_N . If $S'_{\Delta_N}(f;0) = f'(0)$ and $S'_{\Delta_N}(f;1) = f'(1)$, then $S_{\Delta_N}(f;x)$ is said to be of type I. If $S''_{\Delta_N}(f;0) = f''(0)$ and $S''_{\Delta_N}(f;1) = f''(1)$, then $S_{\Delta_N}(f;x)$ is said to be of type II.

C. A. Hall and W. W. Meyer (Cf. JOURNAL OF APPROXIMATION THEORY, vol 16, 1976, pp 105-122) proved

$$\sup_{x \in [0,1]} \frac{\|f^{(r)}(x) - S_{\Delta_N}^{(r)}(f;x)\|_{\infty}}{\|f^{(r)}(x)\|_{\infty}} = \|\hat{R}^{(r)}(x)\|_{\infty}, \quad (1)$$

where $r = 0$ or 1 , $f^{(4)}(x) \not\equiv 0$, $\hat{R}(x) = \frac{E_4(x)}{f^{(4)}(x)}$ ($0 \leq x \leq 1$) and $E_4(x)$ is Euler's polynomial of degree 4. They conjectured that formula (1) is still true when

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$r = 2$ or 3 .

In this paper we prove that this conjecture is wrong and give the following Theorem. Suppose $S_{\Delta_N}(f;x)$ is a cubic interpolating spline of type I (or II) and $f(x) \in C^4[0,1]$.

Then

$$\sup_{x \in [0,1]} \frac{\|f^{(r)}(x) - S_{\Delta_N}^{(r)}(f;x)\|_{\infty}}{\|f^{(r)}(x)\|_{\infty}} = \frac{1 + \sqrt{3}}{4}.$$

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TITLE: "Relations of Eigenvalues and Eigenvectors between SOR Matrix $\mathcal{L}_\omega$ and Jacobi Matrix B "

SOURCE: Beijing JISUAN SHUXUE [MATHEMATICA NUMERICA SINICA] in Chinese Vol 2 No 1, Feb 80 pp 35-40

TEXT OF ENGLISH ABSTRACT: In this note, we extend one of Young's results. When the Jacobi matrix B is weakly cyclic in index $p(\geq 2)$, we establish relations of eigenvalues and eigenvectors between SOR matrix $\mathcal{L}_\omega$ and Jacobi matrix B with simple straightforward derivations.

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TITLE: "On Mathematical Foundations of Bézier's Method"

SOURCE: Beijing JISUAN SHUXUE [MATHEMATICA NUMERICA SINICA] in Chinese Vol 2 No 1, Feb 80 pp 41-49

TEXT OF ENGLISH ABSTRACT: Bézier's method is one of the most famous methods in computational geometry. In his book, "Numerical Control," Bézier gives excellent expositions of the mathematical foundations of his method. In this paper a new expression of the functions $\{f_{n,i}(u)\}$,

$$f_{n,i}(u) = 1 - \sum_{j=0}^{i-1} C_n^j u^j (1-u)^{n-j} \quad (i=1, 2, \dots, n)$$

is obtained. Utilizing this formula, we have not only derived some properties concerning the functions $\{f_{n,i}(u)\}$, for instance

$$f_{n,i}(u) < f_{n,i-1}(u) < \dots < f_{n,1}(u) \quad u \in [0, 1]$$

and functions $\{f_{n,i}(u)\}$ increase strictly at $[0, 1]$, etc., but also simplified

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systematically all the mathematical discussions about Bézier's method.

Finally, we have proved the plotting theorem completely by matrix calculation.

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ORG: None

TITLE: "The Finite Element Methods with Trial Functions Not Fulfilling Essential Boundary Conditions"

SOURCE: Beijing JISUAN SHUXUE [MATHEMATICA NUMERICA SINICA] in Chinese Vol 2 No 1, Feb 80 pp 50-62

TEXT OF ENGLISH ABSTRACT: We consider the finite element methods with trial functions not fulfilling essential boundary conditions. The variational formulation of "Saddle-point" type is applied. The convergent error estimates of optimal order of accuracy are derived. The resulting schemes have the same numerical stability as the Ritz finite element methods.

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TITLE: "On Some Theorems for the Convergence of the Matrices $\mathcal{L}_\omega$ "

SOURCE: Beijing JISUAN SHUXUE [MATHEMATICA NUMERICA SINICA] in Chinese Vol 2 No 1, Feb 80 pp 63-68

TEXT OF ENGLISH ABSTRACT: In this paper we discuss non-negative Jacobi matrices B and successive relaxation matrices $\mathcal{L}_\omega$ ($0 < \omega \leq 1$), prove that they are either both convergent or both divergent, generalize the Stein-Rosenberg theorem, reveal the relations between $\rho(\mathcal{L}_\omega)$ and $\rho(B)$, and give two groups of inequalities of upper- and lower-bound estimates for the spectral radius $\rho(\mathcal{L}_\omega)$.

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TITLE: "Splines of $(2N + 1)$ -th Degree with Coefficients Expressed by Even Order Derivatives"

SOURCE: Beijing JISUAN SHUXUE [MATHEMATICA NUMERICA SINICA] in Chinese Vol 2 No 1, Feb 80 pp 69-76

TEXT OF ENGLISH ABSTRACT: In this paper, a method of constructing splines of the $(2n + 1)$ -th degree is advanced. This method is simple in rules and convenient in computation. Give m points P_i ($i = 1, 2, \dots, m$), through which spline function of the $(2n + 1)$ -th degree in parametric form is

$$P_i(t) = \sum_{j=0}^n [P_i^{(2j)}(0)f_{j,n}(t) + P_i^{(2j)}(1)g_{j,n}(t)], \quad \left(\begin{array}{l} 0 \leq t \leq 1 \\ j = 2, 3, \dots, n \end{array} \right).$$

$P_i^{(2j)}(0)$ and $P_i^{(2j)}(1)$ being the vector derivatives of the $(2j)$ -th order of $P_i(t)$ at $t = 0$ and $t = 1$ respectively, and $P_1^{(0)}(0) = P_{1-1}$, $P_1^{(0)}(1) = P_1$. $f_{j,n}(t)$ and $g_{j,n}(t)$ indicate polynomials of the $(2j + 1)$ -th degree of t , connected by the relation $f_{j,n}(t) = g_{j,n}(1 - t)$, ($j = 0, 1, 2, \dots, n$)

There are only terms of odd degree of t in $S_{2r+1}(t)$, and

$$S_{2r+1}^{(i)}(t) = S_{2r-1}^{(i)}(t), \quad S_{2r+1}^{(i)}(0) = S_{2r+1}^{(i)}(1) = 0, \quad (i = 1, 2, \dots, n).$$

Therefore, the coefficients of $S_{2r+1}(t)$ can be obtained by a simple recurrence formula. If $S_{2r+1}(t)$ expresses the spline function of the $(2r + 1)$ -th degree as stated, then there exists a simple relation between $S_{2r+1}(t)$ and spline function $S_{2r-1}(t)$ of the $(2r - 1)$ -th degree:

$$S_{2r+1}(t) = S_{2r-1}(t) + P_{2r+1}^{(0)}(t)S_{2r-1}^{(1)}(t) + P_{2r+1}^{(1)}(t)S_{2r-1}^{(2)}(t),$$

$$(r = 1, 2, \dots, n, 0 \leq t \leq 1).$$

This relation considerably simplifies the programming and computation. In the cartesian coordinate system of two-dimensions, the convexity of the whole spline curve of the $(2n + 1)$ -th degree can be determined through given points (x_i, y_i) ($i = 1, 2, \dots, n$) by the signs of the even order derivatives $y_i^{(2)}$ at the joint points.

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TITLE: "The Stability for Numerical Integration of System of Ordinary Differential Equations"

SOURCE: Beijing JISUAN SHUXUE [MATHEMATICA NUMERICA SINICA] in Chinese Vol 2 No 1, Feb 80 pp 77-89

TEXT OF ENGLISH ABSTRACT: In this paper the following linear system of ordinary differential equations

$$\frac{dY}{dt} = AY + F(t)$$

is considered, where A is an $(n \times n)$ -dimensional constant matrix, and X and F are n -dimensional vectors.

In view of stability, the essential connection between steps of integration, numerical integrative formula and property of the differential equations are studied, and general criterion of choice of step of integration is given.

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ORG: Beijing Municipal Computing Center

TITLE: "The Finite Differencing Scheme for Absolute Stability Solution of Parabolic Partial Differential Equations of 2- or 3-Dimensions"

SOURCE: Beijing JISUAN SHUXUE [MATHEMATICA NUMERICA SINICA] in Chinese Vol 2 No 1, Feb 80 pp 90-99

TEXT OF ENGLISH ABSTRACT: In this paper, an explicit three-level symmetrical differencing scheme with parameters for solving parabolic partial differential equations of two-dimensions

$$\frac{\partial u}{\partial t} = a \left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} \right), \quad 0 < x, y < \pi, \quad t > 0$$

will be considered. The parameters were chosen by using the method of undetermined coefficients of which the accuracy of as high an order as possible has been reached. Generally, the order of the truncation error is $O(\Delta t^2) + O(\Delta x^2) + O(\Delta y^2)$; sometimes, $O(\Delta t^2) + O(\Delta x^2 \Delta t) + O(\Delta y^2 \Delta t)$ may be reached. We shall introduce a theorem on the relation between roots and coefficients, by which the absolute stability of this scheme is proved. Further, the similar results can be obtained in the three-dimensional case, and we may extend it to

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higher dimensional parabolic partial differential equations.

The important results obtained in this paper, therefore, for the N-dimensional parabolic partial differential equations

$$\frac{\partial u}{\partial t} = a \sum_{i=1}^N \frac{\partial^2 u}{\partial x_i^2}, \quad 0 < x_1, x_2, \dots, x_N < \pi, \quad t > 0$$

are the difference equations

$$\begin{aligned} & \eta_i (u_{i_0, i_1, \dots, i_N}^{n+1} - u_{i_0, i_1, \dots, i_N}^n) \\ & + \eta_i \sum_{j=1}^N \left[(u_{i_0, i_1, \dots, i_N}^{n+1} - u_{i_0, i_1, \dots, i_N}^n) + u_{i_0, i_1, \dots, i_N}^n - u_{i_0, i_1, \dots, i_N}^{n-1} \right] \\ & + \eta_i (u_{i_0, i_1, \dots, i_N}^n - u_{i_0, i_1, \dots, i_N}^{n-1}) = a(1 - \theta) \left[\sum_{j=1}^N (u_{i_0, i_1, \dots, i_N}^{n+1} + u_{i_0, i_1, \dots, i_N}^{n-1}) \right. \\ & \left. + 2N u_{i_0, i_1, \dots, i_N}^n \right] + a\theta \left[\sum_{j=1}^N (u_{i_0, i_1, \dots, i_N}^{n+1} + u_{i_0, i_1, \dots, i_N}^{n-1}) + 2N u_{i_0, i_1, \dots, i_N}^n \right], \end{aligned}$$

which are always stable, and hence it is absolutely stable, if chosen only

$$\theta = \min\left(0, \frac{1}{2} - N\alpha\right).$$

$$\frac{\alpha}{2} - \alpha\theta + \frac{\theta}{2N} \leq \eta_1 \leq \frac{1}{4N} - \alpha\theta.$$

$$\eta_2 = \frac{1}{2} - \theta,$$

$$\eta_3 = \eta_2 - 2N\eta_1 + 2\theta.$$

The orders of the truncation errors of the approximate differential equations are

$$O(\Delta r^2) + \sum_{i=1}^N O(\Delta r_i^2).$$

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TITLE: "Differential Versus Integral Equations and Finite Versus Infinite Elements"

SOURCE: Beijing JISUAN SHUXUE [MATHEMATICA NUMERICA SINICA] in Chinese Vol 2 No 1, Feb 80 pp 100-105

TEXT OF ENGLISH ABSTRACT: Boundary-value problems of elliptic equations may have different mathematical formulations, equivalent in principle but not equally efficient in practice. For example, the Neumann problem of Laplace equations (1), (2) is equivalent to the variational problem (3), (4). The judicious use of the latter formulation leads to the success of the FEM. The problem can also be formulated in terms of integral equations, even in many ways. They have generally the advantage of the reduction both of dimension by 1 and of the infinite domain to the finite, at the expense of increased analytical difficulty. The most well-known reduction is the Fredholm integral equation of the second kind (5), for which w is to be solved and gives the original solution through the integral formula (6). The corresponding integral operator maps $H^3(\partial\Omega) \rightarrow H^3(\partial\Omega)$ and is, in general, not self-adjoint, so one of the characteristic and useful properties of the original problem is lost.

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A lesser-known reduction to the integral equation is in the form (7), for which the boundary value u_0 of the solution u to the original problem is to be solved and gives u through the integral formula (8). The kernel K has the advantage of being self-adjoint and is derived from Green's function by double differentiation, so is highly singular. It is of the type of the finite part of the divergent integral in the sense of Hadamard and maps H^6 onto H^{5-1} and is thus desmoothing by order 1. This is advantageous rather than defective to the solution stability. In addition, the variational formulation equivalent to (7) is (11), (12) which can be obtained from (3), (4) through elimination of interior values of u by means of Green's function. This form of reduction to integral equation is related to the original problem in a more natural and direct way, so it will be regarded as canonical and is more desirable in numerical approach. In fact, the idea of canonical reduction is implicitly used in FEM practice as a technique of substructures. The elimination of the internal degrees of freedom is precisely a discrete analog of the canonical reduction and the resulting algebraic system containing solely the boundary degrees of freedom is precisely a discrete analog of the Hadamard integral equation.

Recently, an elegant scheme of infinite similar elements has been proposed for the solution of crack singularity problems. They are equally well suited for concave corners, intersection of several interfaces, infinite domains and also

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the usual closed domain of regularity. For all these cases, it can be shown that, under certain uniformity conditions, a conforming finite element in infinite similar triangulation converges with its nominal order of accuracy without deterioration. This elimination of an infinite number of the interior degrees of freedom is another example of discrete analog of the canonical reduction.

Figure 1 affords an example problem containing various kinds of singularity and infinite domain. It can be grossly divided into five substructures using infinite triangulation for each. This suggests an economy of problem preparation, storage space and volume of computation. Figure 2 is an infinite triangulation of the unit circle, the finite algebraic system for the boundary unknowns after the elimination of many infinite interior unknowns gives a discrete analog of the Hadamard integral equation (14) with the finite part kernel $1/\sin^2 \theta$ for the unit circle. This is an example of solving an integral equation with explicit use of integral equations, also that of treating finite parts without explicit presentation of finite parts.

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TITLE: "Examples of Bifurcation Solutions for Boundary Valued Problem of Ordinary Differential Equations"

SOURCE: Beijing JISUAN SHUXUE [MATHEMATICA NUMERICA SINICA] in Chinese Vol 2 No 1, Feb 80 pp 106-112

TEXT OF ENGLISH ABSTRACT: In this note, the sufficient conditions for the existence of bifurcation solutions for boundary valued problem $u(-R) = u(R) = u_0$ of ordinary differential equations $(K(u)u')' + \lambda F(u) = 0$ are considered. Several numerical examples are given.

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TITLE: "Invariant Subspaces and Generalized Invariant Subspaces. (II) Perturbation Theorems"

SOURCE: Beijing JISUAN SHUXUE [MATHEMATICA NUMERICA SINICA] in Chinese Vol 2 No 2, May 80 pp 113-123

TEXT OF ENGLISH ABSTRACT: In order to approximate the perturbation bounds for invariant subspaces and generalized invariant subspaces, we suggest an iterative technique for the solution of the quadratic matrix equations which possesses quadratic convergence. Consequently we obtain the corresponding perturbation theorems. At the end we give a numerical example.

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TITLE: "Best Approximation Having Restricted Ranges with Nodes"

SOURCE: Beijing JISUAN SHUXUE [MATHEMATICA NUMERICA SINICA] in Chinese Vol 2 No 2, May 80 pp 124-132

TEXT OF ENGLISH ABSTRACT: In this paper we discuss the problem of best approximation having restricted ranges, while the restricted functions may be arbitrary discontinuous ones, and may take the same values at some nodes, namely $d(1, u) = 0$, and establish in the Chebyshev sense the corresponding theorems, including the alternation theorem.

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TITLE: "Continuity and Derivability for an Interpolation Function of Two Variables"

SOURCE: Beijing JISUAN SHUXUE [MATHEMATICA NUMERICA SINICA] in Chinese Vol 2 No 2, May 80 pp 133-141

TEXT OF ENGLISH ABSTRACT: (1) In this paper, we give an example which shows that the interpolation function by Shepard is discontinuous under some cases. (2) We prove that the interpolation function by Shepard is continuous if datum location can satisfy some conditions which cannot guarantee the existence of a partial derivative.

AUTHOR: SUN Jiachang [1327 1367 2512]

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TITLE: "Generalized Splines in Local Coordinates"

SOURCE: Beijing JISUAN SHUXUE [MATHEMATICA NUMERICA SINICA] in Chinese Vol 2
No 2, May 80 pp 142-145

TEXT OF ENGLISH ABSTRACT: A spline in local coordinates which is more general than that considered in an earlier paper is considered. The spline curve in such a case is independent of the reference local coordinate system. Hence the splines in both the local coordinate in the earlier article and the ordinary one are joined together in a more general sense.

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TITLE: "Penalty Functions and Global Optimization Problems with Inequality Constraints"

SOURCE: Beijing JISUAN SHUXUE [MATHEMATICA NUMERICA SINICA] in Chinese Vol 2
No 2, May 80 pp 146-153

TEXT OF ENGLISH ABSTRACT: In this paper we are concerned with the global optimization problems with inequality constraints. The relationship between the set of global extreme points with constraints and the set of sequential unconstrained global extreme points with penalty are discussed. We point out that the latter is a subset of the former and give the conditions for which both are equal. In addition, we suggest a nonsequential unconstrained method for searching for global extreme points with constraints. This method does have applications in practice.

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TITLE: "Finite Element Methods for Solving Structure Composed by Plate-Beam with Their Error Estimate"

SOURCE: Beijing JISUAN SHUXUE [MATHEMATICA NUMERICA SINICA] in Chinese Vol 2 No 2, May 80 pp 154-171

TEXT OF ENGLISH ABSTRACT: In this paper we study the convergence of a finite element method solution of a structure composed by a plate-beam. To begin with, we give a conforming condition for this composite structure. According to this condition, the finite element methods for solving the composite structure are shown, in general, to be non-conforming. Based on Strang's framework, the convergence of the finite element solutions is proved one by one and their error estimate is given.

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TITLE: "On a Family of Globally Convergent Iteration Processes for Finding Real Zeros of Entire Functions"

SOURCE: Beijing JISUAN SHUXUE [MATHEMATICA NUMERICA SINICA] in Chinese Vol 2 No 2, May 80 pp 172-179

TEXT OF ENGLISH ABSTRACT: This paper offers a family of globally convergent iteration methods which can be used to find real zeros of entire functions with any finite order. Both the m -th root iteration method and the generalized Halley iteration formula have been shown to be the special cases of our formula. Finally, an appropriate modification has been given of the well-known square root iteration method that was first published by L. C. Hsu and A. M. Ostrowski, independently of each other, in 1973.

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ORG: Computing Center, Chinese Academy of Sciences

TITLE: "A Method for Solving Large-Scale and Sparse Linear Programming"

SOURCE: Beijing JISUAN SHUXUE [MATHEMATICA NUMERICA SINICA] in Chinese Vol 2 No 2, May 80 pp 180-183

TEXT OF ENGLISH ABSTRACT: This paper presents a method for solving large-scale and sparse linear programming problems. First an algorithm for finding an elementary matrix is reviewed. Then the computing procedure of the present method is described. Finally, in the last section a technique for saving the computer storage is suggested.

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TITLE: "Method of Multiple Steepest Descent"

SOURCE: Beijing JISUAN SHUXUE [MATHEMATICA NUMERICA SINICA] in Chinese Vol 2 No 2, May 80 pp 184-188

TEXT OF ENGLISH ABSTRACT: In this paper we propose the method of multiple steepest descent. It is of quadratic convergence. If the object function is

$$f(x) = \frac{1}{2} x^T A x - x^T b,$$

where A is an $n \times n$ symmetric positive definite matrix with k different eigenvalues, then after k -time line or search the minimum point of f will be found. In this case we also note that this method is equivalent to the method of partial conjugate gradients.

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TITLE: "Some Notes on E. W. Cheney's Book 'Introduction to Approximation Theory'"

SOURCE: Beijing JISUAN SHUXUE [MATHEMATICA NUMERICA SINICA] in Chinese Vol 2 No 2, May 80 pp 189-191

TEXT OF ENGLISH ABSTRACT: In this paper we point out that (1) Berman's Corollary is also valid for unbounded linear operators and (2) there is an error in the proof of the Existence Theorem of best rational approximation. We endeavor to complete the two proofs. Also, we prove a theorem on the nonsingularity of a certain kind of matrix, which shows that the author's assumption on the ascent algorithm is unnecessary.

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TITLE: "On the Combined Methods of the Boundary Value Problems of Elliptic Equation"

SOURCE: Beijing JISUAN SHUXUE [MATHEMATICA NUMERICA SINICA] in Chinese Vol 2 No 2, May 80 pp 192-194

TEXT OF ENGLISH ABSTRACT: Consider the boundary value problems of the elliptic equation:

$$\begin{cases} -\frac{\partial}{\partial x} \left(\beta \frac{\partial u}{\partial x} \right) - \frac{\partial}{\partial y} \left(\beta \frac{\partial u}{\partial y} \right) = f, & (x, y) \in S, \\ u = 0, & (x, y) \in \Gamma, \end{cases} \quad (1)$$

where S is a convex polygon, Γ is the boundary of S , the functions β and f possess a certain smooth property and $\beta = \beta(x, y) \geq \beta_0 > 0$. There exist the Ritz-Galerkin Method, Finite Element Method and Finite Difference Method (or Conservation Difference Scheme) in the references for solving equation (1). However, only one of these methods is respectively applied in a boundary value problem. In this article we will point out that these separate methods above

may be combined in many ways to be applied to solving the problem of equation (1). Some concrete combined methods and their theoretical analyses are provided in the references.

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TITLE: "A Note on the Bounds of Second Derivatives of Cubic Splines"

SOURCE: Beijing JISUAN SHUXUE [MATHEMATICA NUMERICA SINICA] in Chinese Vol 2 No 2, May 80 pp 195-196

TEXT OF ENGLISH ABSTRACT: Let $s_N(x)$ be cubic splines passing a series of the points (x_j, y_j) , $j=0, 1, 2, \dots, N$, where $x_0 < x_1 < x_2 < \dots < x_N$. It is known that $H_j = s_N''(x_j)$, $j=0, 1, 2, \dots, N$ satisfy equation (A), where the coefficients C_j , A_j , μ_j are known. In this note, the following results are obtained:

$$\begin{aligned} & \text{If} \quad 2C_0 - A_0C_1 \geq 0, \quad -\mu_N C_{N-1} + 2C_N \geq 0, \\ & \quad -\mu_j C_{j-1} + 2C_j - A_j C_{j+1} \geq 0, \quad j=1, 2, \dots, N-1, \\ \text{then} \quad & \frac{C_0}{2} \geq M_0 \geq \frac{C_0}{2} - \frac{A_0}{4} C_1 \geq 0, \quad \frac{C_N}{2} \geq M_N \geq \frac{C_N}{2} - \frac{\mu_N}{4} C_{N-1} \geq 0, \\ & \frac{C_j}{2} \geq M_j \geq \frac{1}{2} \left(-\frac{\mu_j}{2} C_{j-1} + C_j - \frac{A_j}{2} C_{j+1} \right) \geq 0, \quad j=1, 2, \dots, N-1. \end{aligned}$$

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CS01 4009

Nuclear Physics

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TITLE: "The Transport Process of the Coupling System Between the Single Particle and the Phonon"

SOURCE: Beijing YUANZHE WULI [CHINESE JOURNAL OF NUCLEAR PHYSICS] in Chinese
Vol 2 No 1, Feb 80 pp 1-10

TEXT OF ENGLISH ABSTRACT: In the treatment of the transport process of nuclear reactions, the coupling between the single particle degrees of freedom and collective modes is considered. In the framework of the coupling master equations in the weak coupling approximation, the various equilibration properties of the nonequilibrium process are explored and reasonable physical pictures of the coupling effect are given.

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TITLE: "The Treatment of Spurious States in Nuclear Field Theory"

SOURCE: Beijing YUANZHE WULI [CHINESE JOURNAL OF NUCLEAR PHYSICS] in Chinese
Vol 2 No 1, Feb 80 pp 11-18

TEXT OF ENGLISH ABSTRACT: The effective Hamiltonian and the dispersion relation are derived, and the spurious solution of the dispersion relation is given. It is shown that the nuclear field treatment is equivalent to the exact solution after eliminating the spurious states.

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TITLE: "Study of the Fission of the Excited Nuclei Near the Radium"

SOURCE: Beijing YUANZIHE WULI [CHINESE JOURNAL OF NUCLEAR PHYSICS] in Chinese
Vol 2 No 1, Feb 80 pp 19-28

TEXT OF ENGLISH ABSTRACT: The fission phenomena of excited nuclei near the radium formed from 72.5 MeV ^{12}C bombarding with ^{197}Au , nat. Pb , ^{209}Bi have been studied by coincidence measurement of the fission fragments.

The results show that they are characterized by the dominance of the mass symmetric fission. The FWHM of the mass distributions are 26.0, 26.9 and 28.2 amu respectively. The average total kinetic energies released by the most probable fission are 159.0, 164.5 and 161.8 MeV respectively. These results agree with

[Continuation of YUANZIHE WULI Vol 2 No 1, Feb 80 pp 19-28]

those of the former experiments and the semi-empirical analyses. They also agree roughly with Nix's theoretical calculation.

From the analyses of the average total kinetic energies released by the most probable fission, it can be shown that the fission fragments at the moment of scission are not spherical, but partly deformed.

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TITLE: "The Dependence of Average Numbers of Prompt Fission Neutron of ^{239}Pu on Incident Fast Neutron Energies"

SOURCE: Beijing YUANZIHE WULI [CHINESE JOURNAL OF NUCLEAR PHYSICS] in Chinese Vol 2 No 1, Feb 80 pp 29-40

TEXT OF ENGLISH ABSTRACT: Average numbers $\bar{\nu}_p$ of prompt neutron for ^{239}Pu fission induced by neutron with energies from 0.1 MeV to 1.5 MeV have been measured by means of spherical Gd-loaded liquid scintillation counter. The new homemade Gd-loaded liquid scintillator and fast current fission chamber were used in this measurement. In order to obtain the absolute values of $\bar{\nu}_p$, the neutron detection efficiency was calibrated in accordance with (n,p) scattering occurring on a stilbene crystal by collimated monoenergetic fast neutron beams. The experimental data were fitted by a least square method with a straight line $\bar{\nu}_p(E_n) = (2.858 \pm 0.015) + (0.102 \pm 0.017)E_n$.

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TITLE: "The Decay of ^{99}Mo "

SOURCE: Beijing YUANZIHE WULI [CHINESE JOURNAL OF NUCLEAR PHYSICS] in Chinese Vol 2 No 1, Feb 80 pp 41-46

TEXT OF ENGLISH ABSTRACT: The gamma-ray spectra of ^{99}Mo radioactive decay have been studied by using Ge(Li) spectrometers. The gamma-ray energies and the relative intensities of the 14 main transitions have been measured, and the β -decay branching ratio was deduced.

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TITLE: "Measurement of Cross Section for Reaction $^{45}\text{Sc}(n, 2n)^{44}\text{Sc}^m$ and Isomeric Cross Section Ratio σ_m/σ_g "

SOURCE: Beijing YUANZHE WULI [CHINESE JOURNAL OF NUCLEAR PHYSICS] in Chinese Vol 2 No 1, Feb 80 pp 47-52

TEXT OF ENGLISH ABSTRACT: The cross section for the reaction $^{45}\text{Sc}(n, 2n)^{44}\text{Sc}^m$ was measured using the activation method in the 13.15-18.26 MeV neutron energy region. The cross section was measured absolutely at the neutron energy of 14.61 ± 0.28 and 16.76 ± 0.32 MeV and found to be 131.2 ± 6.2 mb and 162.4 ± 9.6 mb respectively. The isomeric cross section ratio (σ_m/σ_g) of the metastable state to ground state was measured at the neutron energy of 14.61 ± 0.28 , 16.03 ± 0.38 , 16.76 ± 0.32 , 17.54 ± 0.16 and 18.26 ± 0.15 MeV. The cross section for ground state σ_g and total (n, 2n) cross section σ_{n+g} for this reaction were determined. The results measured were compared with the existing data and the recommended curve was given.

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TITLE: "The Distribution of Prompt Neutron Numbers for Long Range α -Particle-Accompanied Fission of ^{252}Cf "

SOURCE: Beijing YUANZHE WULI [CHINESE JOURNAL OF NUCLEAR PHYSICS] in Chinese Vol 2 No 1, Feb 80 pp 53-57

TEXT OF ENGLISH ABSTRACT: The distribution of prompt neutron numbers (P_v) and average number of prompt neutrons emitted per fission ($\bar{\nu}_p^{\text{LRF}}$) for long range α -particle-accompanied fission of ^{252}Cf have been measured by means of a large Gd-loaded liquid scintillation counter. The obtained distribution of prompt neutron P_v is in accordance with Gaussian distribution with $\sigma = 1.25$, and the value of $\bar{\nu}_p^{\text{LRF}}$ is 3.033 ± 0.020 .

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TITLE: "Determination of Mössbauer Parameters from Unresolved Spectra"

SOURCE: Beijing YUANZIHE WULI [CHINESE JOURNAL OF NUCLEAR PHYSICS] in Chinese
Vol 2 No 1, Feb 80 pp 59-66

TEXT OF ENGLISH ABSTRACT: In this work we have studied the Mössbauer spectra for samples SnO_2 and $\beta\text{-Sn}$, which consist of two nearly overlapping peaks due to a very small quadrupole split. Our results show that the apparent line width and quadrupole split are sensitive to sample thickness. On the other hand, the effective line width and quadrupole split are obtained by back scattering conversion spectra, and agree with those obtained from the method of extrapolating to zero-thickness. The values are 0.42 ± 0.01 mm/s and 0.50 ± 0.02 mm/s for SnO_2 and 0.42 ± 0.03 mm/s and 0.285 ± 0.017 mm/s for $\beta\text{-Sn}$ respectively. Finally, combining the back scattering with transmission spectra, we have calculated the recoilless factor of the absorber by means of the transmission integration method. These factors are equal to 0.42 ± 0.04 for SnO_2 and 0.034 ± 0.004 for $\beta\text{-Sn}$, respectively.

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TITLE: "Dynamics of Particles in a Six-Dimensional Phase Space"

SOURCE: Beijing YUANZIHE WULI [CHINESE JOURNAL OF NUCLEAR PHYSICS] in Chinese
Vol 2 No 1, Feb 80 pp 67-76

TEXT OF ENGLISH ABSTRACT: After analyzing the state of motion of a pulsing beam, a "space distribution" and a "target measurement" model are suggested. Equations of motion of particles in a six-dimensional phase space are also described. First order transition formulas of the pulsing beam are discussed in this paper. Finally, as a simple example, the equations of transmission for a uniform electrostatic field have been given in a six-dimensional phase space.

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TITLE: "The Measurements of Starting Potential and the Gas Gain of G-M Counters"

SOURCE: Beijing YUANZHE WULI [CHINESE JOURNAL OF NUCLEAR PHYSICS] in Chinese
Vol 2 No 1, Feb 80 pp 77-83

TEXT OF ENGLISH ABSTRACT: In this report, some fundamental parameters of G-M counters' filling of Ar+Alcohol vapor have been given. The relation between the Wilkinson formula and Lauterzung formula is explained and the correct method for measuring the starting potential is described. Particularly, it is proved that the regeneration coefficient of an avalanche is not constant.

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CSO: 4009

Seismology and Geology

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TITLE: "Three-Dimensional Finite Element Analysis of the Relationship between the Stress State of a Rock Mass and the Driving Force"

SOURCE: Beijing DIZHEN DIZHI [SEISMOLOGY AND GEOLOGY] in Chinese Vol 2 No 1, Mar 80 pp 3-10

TEXT OF ENGLISH ABSTRACT: The deformation and failure of rock masses are in general governed by the preexisting discontinuities and the local fissures induced by the state of stress because these weak planes increase the deformability and reduce the strength of the rock mass. The mechanical properties of a rock system are thus determined by its interior structure and texture, as well as by the boundary conditions, such as the loading path, the constrained displacement and the geometry of the system.

This paper describes a three-dimensional finite element model of the rock mass

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where a fault underlain closely with or without a soft layer is dipping at an angle of 60° or 90° between the fault plane and the horizontal axis. The external forces different in magnitude and direction are imposed at the boundaries, and the effect of the intermediate principal stress, σ_2 , on the concentrated stress level at the fault tip is studied as well.

Numerical results similar to those of both the field and laboratory tests confirm that the present model provides physically measurable simulation and thus can be used to study the stress distribution of a geological body under different boundary conditions and to evaluate the geological background causing a huge earthquake.

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TITLE: "Experimental Studies on the Processes of Deformation and Failure of a Typical Rock Mass and Their Relationship to Both the Seismic Precursors and the Foreshocks"

SOURCE: Beijing DIZHEN DIZHI [SEISMOLOGY AND GEOLOGY] in Chinese Vol 2 No 1, Mar 80 pp 11-17

TEXT OF ENGLISH ABSTRACT: This paper deals especially with the propagation of a 2 mm-thick saw-cut inclined 45° to the axis of the rock specimen of 5 x 5 x 12.5 cm and filled with epoxy so as to simulate the development of an earthquake of continental interior. The specimen was loaded in uniaxial compression and attached to a measuring system consisting of strain gauges, acoustic emission and wave traveling.

Characteristics of failure modes observed in these experimental studies were as follows:

1. Creep along the fault face occurred at a very low compressive load without

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any foreshocks. This would generate precursors, such as groundsurface displacements and groundwater level variations.

2. As the load increased, a tearing-off crack started to develop at the existing fault tip nearly perpendicular to the fault plane, and appeared to arise initially from the creep process. The propagation of this primary crack was stable and its path was curvilinear. After considerable primary crack propagation, a second tension crack developed again at the same tip and extended downward to the edge of the specimen, but without any stress drop before overall rupture. During cracking, both the number of acoustic emissions and the wave traveling time increased time went on. The former phenomenon is equivalent to and the latter is caused by the foreshocks.

3. As the compressive load reached a critical level, shear rupture, behaving like a mainshock, took place suddenly at the fault end zone under intensively compressive stress concentration and was directed relatively to the tension cracks with angles varying from $>30^{\circ}$ to $<90^{\circ}$. Obviously this was due to the distribution of both the unadmissible shear stress from the sliding plane and the tensile stress from the cracked zone to the neighboring region capable of sustaining an increase of stress.

Finally, our results, applied to the prediction of continental earthquakes, suggest that a large shock should be preceded first by a fault creep and then by a

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number of small shocks in tensile cracked regions trending in different directions from the main shear failure plane. In other words, the processes of deformation and fracture of a rock mass would vary in time and in space, which may be used as a guide in estimating as well as possible the relative locations of precursors and foreshocks to the mainshocks.

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TITLE: "The Implication of Conjugate Faulting in the Earthquake Brewing and Originating Process"

SOURCE: Beijing DIZHEN DIZHI [SEISMOLOGY AND GEOLOGY] in Chinese Vol 2 No 1,
Mar 80 pp 19-26

TEXT OF ENGLISH ABSTRACT: The earthquake sequence, precursory and geologo-structural background of the Haicheng, Tangshan, Songpan-Pingwu earthquakes are discussed in this article. As we know, all of these earthquakes occurred in a seismic zone controlled by the main boundary faults of an intraplate fault block. However, the fault plane of a main earthquake does not consist of the same faults, but is rather a related secondary fault. They formed altogether a conjugate shearing rupture zone under the action of a regional tectonic stress field. As to the earthquake sequence, the foreshocks and aftershocks might occur on the conjugate fault planes within an epicentral region rather than be limited to the fault plane of a main earthquake, such as the distribution of

foreshocks and aftershocks of the Haicheng earthquake. The characteristics of the long-, medium- and imminent-term earthquake precursory anomalies of the three mentioned earthquakes, especially the character of well-studied anomaly phenomena in electrical resistivity, radon emission, groundwater and animal behavior, have been investigated. The studies of these earthquake precursors show that they were distributed in an area rather more extensive than the epicentral region. Some fault zones in the conjugate fault network usually appeared as distributed belts or concentrated zones of earthquake precursory anomalies, and can be traced in the medium-long term precursory field, but seem more distinct in the short-imminent term precursory anomalous field. These characteristics can be explained by the rupture and sliding originating along the conjugate shear network and the concentration of stress in the regional stress field. In addition, it is worthwhile to note the migration of these precursory anomalies along the conjugate rupture zone in the earthquake-brewing process. The macroscopic precursory anomalies of the Songpan-Pingwu and Haicheng earthquakes did not appear first in the epicentral region, but emerged in a set of fault zones conjugated with the fault plane of the main earthquake, or in a conjugate fault zone and its intersection region. These phenomena may have originated from the migration of a stress-concentrated region and continuous concentration of stress in the earthquake source area. It is also possible that they were progressively initiated at a definite direction along the rupture zone and sliding caused by conjugate faulting.

It can be supposed that the effect of conjugate faults on the earthquake brewing and originating process is significant in theoretical studies of seismology and in predicting practice, and it should be drawing public attention.

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TITLE: "The Characteristics of Intraplate Earthquake Faults in North China and Their Relationship to the Dynamical Processes in the Earth's Crust and Uppermost Mantle"

SOURCE: Beijing DIZHEN DIZHI [SEISMOLOGY AND GEOLOGY] in Chinese Vol 2 No 1, Mar 80 pp 27-38

TEXT OF ENGLISH ABSTRACT: The mechanical nature of 121 earthquake faults, the strikes of 40 events and the directions of fracture propagation of 15 events are discussed in this paper. Based on these, some relationships between the strikes of intraplate earthquake faults in north China and the distributions of uplifted zones of the uppermost mantle have been found, e.g., within these zones the earthquake faults run nearly parallel to their elongation, while on the opposite sides the earthquake faults are mainly perpendicular to their elongation. However, it seems to be that the mechanical nature and the direction of fracture propagation are not controlled by the pattern of rising of the uppermost mantle, but coincide with the general characteristic feature in the eastern part of China.

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The authors hold that there exist two types of geodynamical processes in north China, the one being that the north China fault blocks are subjected to a compression trending NEE-SWW due to the eastward movement of the Xizang (Tibet) block, and the other being that the diapirism of the uppermost mantle and the gravity isostasy make the continental crust of north China thinner and its certain parts to have a lens-shape. The characteristics mentioned above and the cause of the high seismicity in north China could be explained by the superimposition of these two dynamical processes.

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TITLE: "Multipoints (Concentrated) Stress Field and Earthquakes in North China Crust"

SOURCE: Beijing DIZHEN DIZHI [SEISMOLOGY AND GEOLOGY] in Chinese Vol 2 No 1, Mar 80 pp 39-47

TEXT OF ENGLISH ABSTRACT: It is assumed that the continental crust, such as the north China crust, behaved as an elastic plate cut by faults with various trends. Due to the complexity of crustal structure, during crustal movement a lot of stress-concentrated points would be formed where the most precursor phenomena are clustered. Some of these points would become sources of future earthquakes. In this paper an attempt is made to explain two kinds of phenomena by the concept of multipoints stress field, that is, 1) there exists an isolated precursory-concentrated area long before the earthquake occurrence and 2) the strong earthquakes take place continuously and frequently in a short period, for instance, the series of strong earthquakes in north China.

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TITLE: "On the Origin and Development of Migmatization"

SOURCE: Beijing DIZHEN DIZHI [SEISMOLOGY AND GEOLOGY] in Chinese Vol 2 No 1, Mar 80 pp 49-63

EXCERPTS FROM ENGLISH ABSTRACT: Based upon the petrological analysis under a microscope, the thermodynamic method and the data of anatexis, some mineral reaction formulae and their paragenesis assemblages are presented in this paper. They can be divided into two different stages during the processes of migmatization as follows: Anatexis and differentiation in the first stage and migmatization and metasomatization in the second stage.

It is considered that the reaction formulae presented in this paper are in keeping with the general rule controlling the development of migmatization.

Firstly, problems with the temperature and pressure of migmatization and the parent rocks of migmatites are also discussed.

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TITLE: "The Characteristics of the Forerunner Field of Underground Water Regime During the Tangshan Earthquake and Its Focal Evolution Process"

SOURCE: Beijing DIZHEN DIZHI [SEISMOLOGY AND GEOLOGY] in Chinese Vol 2 No 1, Mar 80 pp 65-78

TEXT OF ENGLISH ABSTRACT: On the basis of data obtained from long-term observations of groundwater regime and taking the Tangshan earthquake as an example, the authors proposed first the principles and approaches for recognizing the precursory anomalies of earthquakes and classified the subsurface water regime into underground water, interlayer water and confined water. For the Tangshan earthquake, the forerunner field of underground water is characterized by its spatial distribution (limited to a certain quadrant), its stages of development in time and the synchronism of anomaly-changes during and after a shock.

In addition, this study stresses the importance of the principles mentioned

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above in predicting the space, time and magnitude of future earthquakes and discusses the relationship between the focal stress field and regional stress field and the indicator to distinguish them. It is suggested that the former develops progressively and its principal axis of compression stress changes in direction just before an earthquake, thus enabling us to divide the focal process into two basically different stages--brewing and originating stages.

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TITLE: "Evidence of Plate Activity in the Himalayas and a Model for Formation of the Qinghai-Xizang Plateau"

SOURCE: Beijing DIZHEN DIZHI [SEISMOLOGY AND GEOLOGY] in Chinese Vol 2 No 2, Jun 80 pp 1-10

TEXT OF ENGLISH ABSTRACT: On the basis of data collected in recent years by the scientific expedition in the Qinghai-Xizang region, the principal structural features of the Himalayas and the Qinghai-Xizang Plateau are discussed from the viewpoint of plate tectonic theory.

In the light of considerable data, such as that on the geological history, sedimentary characteristics, distribution of Gondwana sedimentary facies, ophiolite suite, melange and exotic blocks, the crustal deformation nature, the regularity of magmatic activity and paired metamorphic belt on both sides of the Yarlung Zangbo River, this work deals with the pattern and nature of plate

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motion, makes a subdivision of Himalayan orogeny and gives a preliminary analysis of its character as well.

A possible model of formation of the Qinghai-Xizang Plateau by multi-underthrusting and multi-matching is presented and it is suggested that the Bangong Co-Dongqiao tectonic belt can probably serve as the northern boundary of Gondwana land. Also, we propose a new mechanism that the Yarlung Zangbo Jiang tectonic belt was opened in Mesozoic and closed in Early Tertiary.

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TITLE: "The Results of Deep Sounding by Using Converted Waves of Earthquakes in the Beijing-Tianjin-Tangshan Region"

SOURCE: Beijing DIZHEN DIZHI [SEISMOLOGY AND GEOLOGY] in Chinese Vol 2 No 2, Jun 80 pp 11-20

TEXT OF ENGLISH ABSTRACT: During the past four years (1975-1979), eight seismic profiles have been compiled by using the method of earthquake-generating converted waves in the Beijing-Tianjin-Tangshan region. Some details about the method of interpreting these data and the important results obtained are presented in this paper. This method is very useful in the regional investigations of the earth's crust and upper mantle.

The comparison of the deep-seated structures and the distribution of earthquakes in the region studied indicates that all hypocenters of strong earthquakes just filled in some particular position of the granitic layer and that the Tangshan

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and Mafan strong earthquake regions are similar to each other in the deep-seated structure characteristics, such as relative uplift of the granitic layer, intensive depression (concavity) of interfaces in the upper mantle, sharp thickening of lithosphere and existence of deep-seated faults in the region under investigation.

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TITLE: "The Features of Highly Electrical Conductivity Layer in North China and Northwest China Regions"

SOURCE: Beijing DIZHEN DIZHI [SEISMOLOGY AND GEOLOGY] in Chinese Vol 2 No 2, Jun 80 pp 21-29

TEXT OF ENGLISH ABSTRACT: The magnetotelluric soundings reveal the existence of a high conductivity layer in the middle crust and upper mantle in certain regions of north China and northwest China. It has an important significance in studying the structures within the crust and upper mantle, physical state of rocks, crustal seismicity and so on. This paper summarizes all the data of highly electrical conductivity layers in these regions and describes their distribution regularity and their coincidence with the tectonic characteristics and temperature, gravity and wave velocity fields. Finally, the genetic mechanism of these layers and its relation to the continental shallow shocks are briefly discussed.

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TITLE: "The Development of Precursory Field and the Tectonomechanical Condition in the Haicheng-Tangshan Earthquake Series"

SOURCE: Beijing DIZHEN DIZHI [SEISMOLOGY AND GEOLOGY] in Chinese Vol 2 No 2, Jun 80 pp 31-42

TEXT OF ENGLISH ABSTRACT: An earthquake series is referred to when the events take place successively during a definite time and in the same seismic area. These events are characterized by the common developing process and a unified evolutionary history of precursory field. We consider the seismic precursory field to be nothing but a regional field beyond a certain source region.

In the north China fault block region two earthquake series can be recognized, the Xingtai-Bohai and Haicheng-Tangshan series, from the occurrence of the Xingtai earthquake of 1966 to 1978. The anomalies in the precursory field of this series started in 1972, but after the 1976 Tangshan earthquake it has been gradually becoming quiet.

With regard to the developmental process of this field and its spatial distribution, the following five anomaly development periods and relevant six stages can be distinguished:

1. The primary period (A), during which the precursory field is developed from the stage in a scattered form (I) to a divergent stage on a large scale (II).
2. Accelerated period (B) before Haicheng earthquake, during which the precursory field migrates northward entering into a convergent stage (III) in the extent.
3. Developing period (C), during which the precursory field enters into a re-divergent stage (IV).
4. Transitional or Accelerated period before the Tangshan earthquake (D), during which the precursory field enters into a reconvergent stage (V).
5. Impending period before the Tangshan earthquake (E), during which the precursory field enters into a divergent stage (VI).

It is suggested that the formation and development of the precursory field are closely related to the conjugated shear-rupturing network, and the distribution and development of anomalous points or zones are constrained by slipping of conjugated shear-ruptures and stress concentration at the various tectonic positions. Consequently, the precursory phenomena would not be limited to the source area and its neighboring regions, and the multi-anomalous regions (zone) are formed.

Finally, the relationship of the regional precursory field with the earthquake prediction is studied. In general, the regional precursory field does not imply only one event, but perhaps an earthquake series, and the precursory extent has a certain relation to the magnitude of an event. To discriminate the location of one shock from the earthquake series it is necessary to pay attention to the spatial changes in the precursory field, such as the migration and convergence of anomalies. Concerning the background of regional precursory fields, the macroscopic anomalies in a great amount and concentrated form together with some abrupt anomalies can be taken as a precursory signal of a big imminent earthquake.

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TITLE: "The Tangshan Earthquake and the Earthquake Risk Area"

SOURCE: Beijing DIZHEN DIZHI [SEISMOLOGY AND GEOLOGY] in Chinese Vol 2 No 2,
Jun 80 pp 43-54

TEXT OF ENGLISH ABSTRACT: In this paper, having considered different viewpoints of seismogenic structures of the Tangshan earthquake, the seismogenic mode of the Tangshan earthquake has been studied using the finite element method. The characteristics of the Tangshan earthquake are also described.

A preliminary discussion has been made on identifying the earthquake risk areas on the basis of both regional stress direction and condition of stress release.

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TITLE: "The Basic Configuration of Crustal Structure in North China Region and Its Relation to the Earthquakes from Gravimetric Data"

SOURCE: Beijing DIZHEN DIZHI [SEISMOLOGY AND GEOLOGY] in Chinese Vol 2 No 2,
Jun 80 pp 55-60

TEXT OF ENGLISH ABSTRACT: Using gravity data the depths of Moho and Conrad discontinuities in the north China region are calculated and thus the basic configuration of crustal structure in this region can be determined. The results obtained indicate that three seismic belts, namely NW trending belt extending from the Bohai Bay through Beijing to Zhangjiakou, Hebei belt with Mt. Taihangshan as a symmetric axis, and Shanxi belt, are located in the relatively uplifted portion of the upper mantle in regard to their depths. Therefore, it is considered that isostatic adjustment exerts an effect on the development of geological structures and the formation of their basic configuration to a large extent. Consequently, these processes control the seismic activity in north China.

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TITLE: "Analysis of Tectonic Conditions for the 1978 Haicheng Earthquake with Magnitude of 6.0"

SOURCE: Beijing DIZHEN DIZHI [SEISMOLOGY AND GEOLOGY] in Chinese Vol 2 No 2, Jun 80 pp 61-69

TEXT OF ENGLISH ABSTRACT: The similarity in the seismogenic structure, rupture mode and the focal stress field indicates that the earthquake of magnitude 6.0 which occurred in Haicheng on 18 May 1978 can be regarded as a strong aftershock of the 1975 Haicheng earthquake with magnitude 7.3. After the main earthquake there were not any intensive activities of aftershocks. However they took place much later, which may be explained by the disruption of the locked section of NNE-running active structure.

The authors of this paper refer to the strong shocks taking place within 10 years after the main shock as being the late strong aftershocks. By the synthetic analysis of the geotectonic features and the nature of the whole seismic

[Continuation of DIZHEN DIZHI Vol 2 No 2, Jun 80 pp 61-69]

activity series of the Haicheng earthquake, it is shown that the multi-locking structures must be a necessary background and the locations for generating the late strong aftershocks. Its anomalous precursor, however, was less obvious and appeared only along the direction obliquely crossing the principal structure in the area concerned. Some characteristics of the late strong aftershocks and relevant strike-slip mechanism are also discussed.

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TITLE: "Chronology of Late Quaternary Deposits along the Coast of Bohai Bay"

SOURCE: Beijing DIZHEN DIZHI [SEISMOLOGY AND GEOLOGY] in Chinese Vol 2 No 2, Jun 80 pp 71-78

TEXT OF ENGLISH ABSTRACT: Radiocarbon datings indicate that the marine deposits at the depths of 23-40 m along the coast of Bohai Bay were formed soon after the stop of the peat development (32000-22900 yr BP), which is comparable with the sub-interglacial periods of the last glacial epoch (about 44000-29000 yr BP) and is agreeable with the high sea level period over the whole world in the late stage of the Late Pleistocene (about 35000-23000 yr BP).

[Continuation of DIZHEN DIZHI Vol 2 No 2, Jun 80 pp 71-78]

The lacustrine-swamp peaty deposits or puddly deposits of various thicknesses have a wide distribution at the depths of 12-16 m beneath the ground surface and 5-6 m depth below the Bohai Sea floor with 20-30 m water depth. In the light of radiocarbon datings, the peaty deposits concerned can largely be placed in Early Holocene (about 10000-8000 yr BP) and named the Lijiabao Formation. It can be correlated with the Purangdian Formation of Liaonan region. Above the peaty deposits are developed in succession a series of marine sediments. From the radiocarbon datings of shelly beds and oyster-bearing beds in offshore and epicontinental sediments from the underlying peaty deposits and marine sediments, especially from the top of the latter, the marine sediments may have been formed in the Middle Holocene (about 8000-2500 yr BP) and named the Houcheng-zhuang Formation, which can be correlated to the Dagushan Formation of Liaonan region. Most of the recent deposits near the ground surface are of fluvial facies, and the peaty deposits are also found in the swamp or the ancient river course. From the radiocarbon datings it can be suggested that the marine sediments beyond the 11 chenier ridge along the western coast of the Bohai Bay and the continental sediments within the 11 chenier ridge both are less than 2500 yr, belonging to the Late Holocene and correlating to the Zhuanghe Formation of Liaonan region. It is referred to as the Qikou Formation.

The lithological changes happening in this region and the datings of Holocene

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deposits indicate that there had been a transgression in the Holocene period and sea water arrived at the studied region 7000 years ago. Later on the transgression reached its maximum in the region 6000-5000 years ago when many regions, such as Leting, Luaman, Ninghe, Tianjin, Cangzhou, Huanghua and Haixing, along the coast of the Bohai Bay were submerged or affected by sea water. About 4000 years ago there was started a regression forming successively the Tongju-Qianmiaozhuang (4700-4000 yr BP), the Zhangguizhuang-Changzhuang (3800-3000 yr BP), the Baishaling-Nigu-Qikou (2500-1500 yr BP) and the Chengtougou-Dagu chenier ridges (600-500 yr BP).

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TITLE: "A New Cleaner To Remove Sea-Surface Pollution: Floating Oil Recovery Ships"

SOURCE: Beijing JIANCHUAN ZHISHI [KNOWLEDGE OF SHIPS] in Chinese No 3, 20 Jun 80 pp 8-9

ABSTRACT: The removal of floating oil from the sea surface is accomplished by several types of ships. In the pump-operated type, a large pickup device suspended from a boom is connected by a hose to a pump aboard ship. The oil and water on the surface are swirled in the collector, and the lighter oil remains in the central section and is pumped into the ship. Another design uses a wheel coated with polyurethane foam or another material with a strong affinity for oil to pick it off the water surface, after which it is squeezed out of the foam by rollers and recovered. A third type of ship has an opening in the bow which extends to slightly below the water level. When the ship is moving, the oil film passes through the opening and strikes a slanted plate, down which it moves into a collection tank. An American-Canadian variation has a moving surface down which the oil travels. A German ship can open its bow like a gate to take in a breadth of 80 meters. Moving at

[continuation of JIANCHUAN ZHISHI No 3, 20 Jun 80 pp 8-9]

3 knots, it can collect 800 cubic meters per hour or 15,000 cubic meters per day of oil. Many oil recovery ships are dual purpose designs, doubling as dredges, oil tankers and the like.

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TITLE: "A New Area Explosive: The Fuel-Air Explosive"

SOURCE: Beijing JIANCHUAN ZHISHI [KNOWLEDGE OF SHIPS] in Chinese No 3,
20 Jun 80 p 17

ABSTRACT: Most explosives used in warfare are "point" explosives; but fuel-air explosives are "area" explosives. With these weapons, a cloud of liquid explosive such as ethylene oxide is released, then detonated. Originally the explosive was delivered by bombs which released many smaller bomblets, whose fall was braked before they released the explosive. More recently, rockets and mortars have been used for delivery, and the dispensing projectile need not be slowed in its flight. These explosives have promise not only as a naval weapon, but as an antiballistic missile weapon as well. Currently research is focusing on ways of making fuel-air explosives effective in the rarefied upper atmosphere and on increasing their lethal area.

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TITLE: "Shipborne Guided Missiles of the Future"

SOURCE: Beijing JIANCHUAN ZHISHI [KNOWLEDGE OF SHIPS] in Chinese No 4,
20 Jul 80 pp 2-4

ABSTRACT: Guided missile-carrying ships of 20-30 years hence will probably be powered either by nuclear energy or by liquid hydrogen. A likely design will be a submersible-hydrofoil type, which will be similar to the ordinary hydrofoil but will be capable of submerging to avoid anti-ship missiles. Its underwater detection techniques may be aided by dolphins; it will also use combined radio and radar techniques for detection, search and identification. Neutron warheads may be used. Because of the necessity of destroying anti-ship missiles at a range of 2,000 meters or more, particle beams and high-powered lasers will be used for defense. In turn, ceramic materials may be used in missiles. Multiple-warhead ship-to-air missiles will probably appear. Sophisticated computer systems using very large scale integrated circuit or magnetic bubble memory and very high speed integrated circuit computers will be used for guidance. Missiles will use radar or radio tracking at long range and heat seekers for closer range. Satellites will be used to guide anti-ship ballistic missiles and may launch their own missiles.

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TITLE: "Rapidly-Developing Supercharger Technology"

SOURCE: Beijing JIANCHUAN ZHISHI [KNOWLEDGE OF SHIPS] in Chinese No 4,
20 Jul 80 pp 10-11, 13

ABSTRACT: The most promising way of increasing the power of diesel engines is to increase the average effective pressure. Supercharging can increase power from 30 to 100 percent or even more, and greatly improve fuel efficiency. A mechanically-driven supercharger uses some of the engine's power for supercharging; an exhaust turbo supercharger makes use of waste energy in the exhaust gases; in addition there are combined mechanical and turbine types. A fixed-pressure supercharger feeds the exhaust gas from all cylinders into a single tract so that the gas pressure used in the supercharger remains fairly constant; pulsed-type superchargers are also used. To increase the average effective pressure above 22-23 atmospheres, two-level superchargers may be used. A super-supercharger has been proposed; in addition to using the exhaust gases, it also uses additional gas for the turbine produced by a separate combustion chamber.

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TITLE: "An Ideal Power Source for Small Submarines: Fuel Cells"

SOURCE: Beijing JIANCHUAN ZHISHI [KNOWLEDGE OF SHIPS] in Chinese No 4,
20 Jul 80 pp 18-19

ABSTRACT: Fuel cells represent a good power source for small submarines used for rescue, deep-sea research and military purposes. They produce electricity by means of a redox reaction in which the efficiency is 50-88 percent, compared with 40 percent for diesel engines. The United States used fuel cells with 70 percent efficiency in the Gemini and Apollo programs. The United States had a 20-kW hydrogen-oxygen fuel cell on a small submarine in 1972, upgrading it to 30 kW in 1977. The French produced a hydrazine-hydrogen peroxide fuel cell which produced 1 kW/liter and installed it on a ship in 1970. The Japanese, Germans and Swedes are also investigating submarines powered by fuel cells. A diagram of fuel cell operation and a table of cost and efficiency of several types of fuel cells, batteries and engines are provided. Although fuel cells are complex and at low and high powers are not as efficient as other approaches, when cost, dimensions, weight and reliability are all considered they are the best alternative for ships requiring several tens of thousands of kilowatts for sailing times of a few hours to a few dozen days.

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TITLE: "Low-Altitude Penetration by Anti-Ship Missiles"

SOURCE: Beijing JIANCHUAN ZHISHI [KNOWLEDGE OF SHIPS] in Chinese No 4,
20 Jul 80 pp 26-27

ABSTRACT: Anti-ship missiles follow the trend in aircraft of using very low altitude attack (200-400 meters) rather than high altitude attack. This makes it difficult for radar to detect them and provides only a short time for destroying them after detection. Extremely rapid-fire shipboard 20-mm cannon have been developed to combat them, but these have not yet proven very effective. Decoy methods of defense may be more effective: heat-seeking missiles can be decoyed with pyrotechnic shells and radar homing missiles with chaff shells.

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